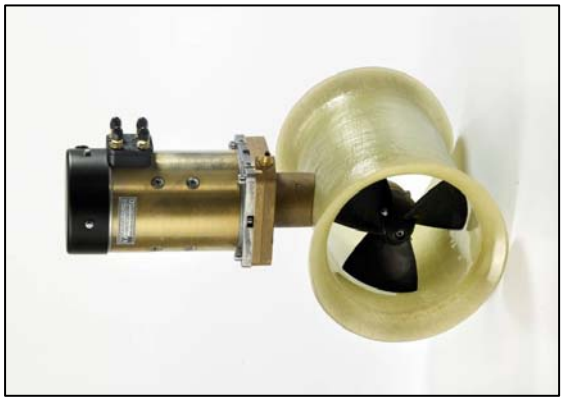
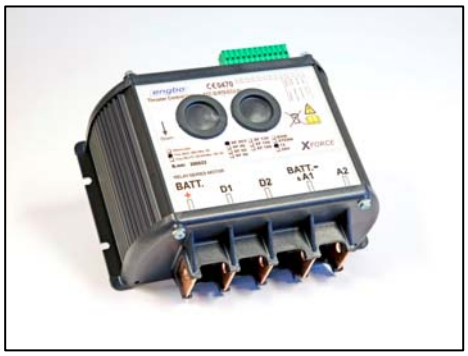
XFORCE
ENGBO THRUSTER SYSTEMS

Installation and user manual
XForce stern-thruster series

XF 60 Stern
XF 90 Stern
XF 130 Stern





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Contents

1. INTRODUCTION 3

2. OPERATION 4

2.1. XForce intelligent protection control 4

2.2. How to operate the thruster 4

2.2.1. Operating panel versions 4

2.3. Operating instructions. 5

2.3.1. Directions for use 5

2.4. Upgrade to wireless remote control. 6

2.4.1. Antenna installation 6

2.4.2. Battery replacement 7

3. TECHNICAL SPECIFICATIONS WIRELESS REMOTE CONTROL 7

4. DIMENSIONS 8

4.1. XF Stern thruster dimensions 8

4.2. Control Unit dimensions 8

5. INSTALLATION 9

5.1. Avoid water damage 9

5.1.1. Compartment area 9

5.1.2. Determine the location for the stern thruster 10

6. MECHANICAL INSTALLATION 10

6.1. Exploded view XForce 90 Stern 10

6.2. Propeller installation 12

7. ELECTRICAL CONNECTIONS 13

7.1. Installation- touch panel 13

7.2. Installation- joystick 13

7.3. Connecting the control cable 14

7.4. ontradicting direction 14

7.5. Control box connections 15

7.6. Connecting to the bow thruster 15

7.6.1. Motor terminal connections 16

7.6.2. Connecting the cables to the battery 16

7.7. Fuse connections 17

7.8. Recommended main switch 17

7.8.1. Main switch terminal 17

7.9. XForce Thruster Cable, fuse and battery requirements 17

7.10. Wiring diagrams 18

7.10.1. XForce stern 60/90/130 18

7.10.2. Wiring diagram single and double joystick 19

8. MAINTENANCE 20

8.1. Mechanical check 20

8.2. Corrosion check 20

8.3. Battery/charger check 20

8.4. High current cable/connections check 20

8.5. Joystick/operator panel check 20

9. TROUBLESHOOTING 21

9.1. The thruster does not work 21

9.2. The thruster does not work or has an unexpectedly low performance 21

9.3. The thruster runs in the wrong direction 21

9.4. The thruster just works in one direction 21

9.5. The thruster runs in contradicting direction 21

9.6. The thruster runs for short intervals or a clicking sound is to be heard from the thruster 22

9.7. The thruster stops working after a long period of use 22

10. INSTALLATION OF EQUIPMENT WITH HIGH CURRENTS. 22

10.1. Special considerations. 22

10.1.1. Preface/introduction....22
10.2. Battery....23
10.2.1. Battery-cables/lugs....23
10.2.2. Battery connection....23
10.2.3. Fuse connection....24
10.2.4. Main switch connection....24

1. Introduction

First of all, we would like to thank you for choosing the XForce Thruster. Engbo AS has for several years supplied Volvo Penta with thrusters, distributed as QL thrusters through Volvo Penta dealers and distributors. In late 2006, Engbo and Volvo Penta agreed that distributing through two channels and brand names would make our thrusters even more available. Together with Engbo anchoring and mooring systems, the thrusters constitute a complete system for manoeuvring and mooring your vessel. The control units on both thrusters and winches are based on the same modules, which makes it possible to manoeuvre and anchor using one single wireless remote control.

To achieve maximum benefit from your XForce thruster, please study this manual thoroughly before installing and making use of the thruster panels. Keep this manual onboard. Do not hesitate to contact us if you have any questions.

Best regards,

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N-3103 Tønsberg
Norway
E-mail: support@engbo.no
Web: www.engbo.no

IMPORTANT:
Please read the entire instruction carefully before starting on the installation work.
The installation instructions are only produced for professional use of qualified personnel and are not intended for non-professional use. Engbo will not assume any liability whatsoever for damage incurred, either damage to materials or personal injury, which may result if the installation instructions are not followed or if the work is carried out by non-professional personnel.
The manufacturer does not assume any liability for the installation of the thruster panels. Qualified installers should be familiar with these installation instructions. The responsibility for the installation rests entirely on the installer. Compliance with regulations must be ensured by the installer.
Faulty installation or connection of any components will render any warranty given by Engbo AS void.

IMPORTANT:
When installed in boats approved or classified according to international or special national rules, the installer is responsible for following the demands in accordance with these regulations / classification rules. The instructions in this manual cannot be guaranteed to comply with all different regulations / classification rules. The remote control is approved for use in EU/EFTA countries (CE) or US/Canada (FCC). For other countries, please contact your local authorities.

2. Operation

IMPORTANT:
XForce thruster(s) must only be operated by persons with knowledge of the system.
Keep main engine(s) running when operating thruster(s) to ensure enough electrical power.
Only operate the thruster(s) with the propellers fully submerged.

Test running
WARNING:

- Do not operate the thruster(s) without the belt cover installed.
- Make sure no one is within reach of the rotating propeller(s)
- The propeller(s) must come to a stop before running in opposite direction, otherwise the contactors will burn / fuse.

NB: When the boat is launched check that it moves in the correct directions when operating the control panel. If not, shift the cables connected to no. 1 and no. 3 on the control unit, or when it concerns MCU with integrated radio receiver, change position on DIL switch 8 on S100 (see 7.4).

2.1. XForce intelligent protection control

Intelligent electronic protection control

- Automatic intelligent monitoring will shut off the thruster if too low voltage.
- The system has intelligent monitoring to measure run and pause time. The XForce Thruster is not permitted to start if the voltage on the thruster is below 10.0V on 12V system/ 20.0V on 24V system. If the voltage at the thruster drops below 9.0/18.0V when thruster is running, warning will occur by showing orange light power light on the wireless control.
- Electronic protection system prevents the thruster from continue to run in case of solenoid lock-in. (Solenoid versions.)

Max continuous running time: 4 intervals of 30 sec – S2 = 2 min.

- Automatic intelligent monitoring measures run and pause time to protect the motor and control unit against overheating.
- Of security reasons, the system permits continuous running of the thruster in 4 intervals of 30 sec. After each interval, the thruster will stop. Switching off / on the joystick or switch panel will make the thruster run again. If repeated 4 times, (total 2 minutes running), the thruster will need to cool down for 25 minutes before being ready to run again. This to protect the motor and control unit against overheating.
  NB: In an emergency situation, to save the ship at the possible expense of the thruster, this protection can be override by turning the main switch off and on.
- Time delay when changing direction protects against mechanical and electric overload.
- Shear pin between thruster motor and drive shaft protects mechanical parts if the propeller is obstructed from rotation.

2.2. How to operate the thruster

- **Move the joystick / press the touch panel to right and the thruster will be activated to starboard.**

- **Move the joystick / press the touch panel to left and the thruster will be activated to port.**

2.2.1. Operating panel versions

There are 4 different XForce Thruster panels available.

Touch panel (Part no.12-79001**)**

- Easy to install.
- Designed similar to Engbo winch panel.

Single Joystick (Part no.12-79002)

- **ON/OFF** switch,
- LEDs for indication of power and direction.

Double joystick (Part no.12-79003)

- Needed if both bow and stern thruster installed.
- **ON/OFF** switch.
- LEDs for indication of power and direction.

Wireless remote control (Part no.12-47014)

- Floating, splash-proof, hand-held remote control unit.
- The wireless remote control can be used to operate maximum two thrusters and two windlasses, bow and stern.
- Activates both bow and stern thruster simultaneously in opposite direction by pushing the centre buttons.
- Operation range of +30 m under normal conditions.
- High quality, narrow band unit with two-way communication with the electronic control unit.
- Each electronic control unit has a unique code.
- Equipped with anti-slip strips on the back.
- Hand/neck cord is included as standard (easily removed).
- The battery lifetime is more than 2 seasons based on normal leisure use.

IMPORTANT! Always install at least one fixed XF Thruster panel.

2.3. Operating instructions.

The remote control is battery-operated. To ensure longer life, it will automatically go into sleep mode five minutes after the last button was pushed. Deactivation is signalled with two short sound bursts and a blinking “POWER” indicator. The remote control is activated by holding down any button for 1.5 seconds. When the remote control has been activated, the selected thruster can immediately be operated by pressing the “arrow” button in the desired direction. The thruster will be running as long as the button is depressed. (Max 4x30 sec.)

2.3.1. Directions for use.

- Push the left arrow button, and the thruster moves the boat to port.
- Push the right arrow button, and the thruster pushes the boat to starboard.
- Pushing the centre (twin arrow) buttons on the wireless remote activates both bow and stern thruster simultaneously in opposite directions. The boat will start to rotate about the vertical axis. (Requires both bow and stern thrusters installed.)

Green light
NB: Activation is indicated by a steady green light in the “POWER” indicator and a short sound. All subsequent use of buttons is shown on the associated indicator above the button, accompanied by a short sound.

Orange light
Low voltage at the electronic unit is indicated by an orange light in the “POWER” indicator.

Red light
The indicator will quickly blink red in case of system faults and slowly blink red together with short sounds if the remote is unable to communicate with the electronic unit.

If the thruster is overloaded and requires time to cool down, this will also be indicated by quick red flashing.

These error messages are shown when buttons are pushed.

2.4. Upgrade to wireless remote control.

XForce Thrusters can be delivered with 3 different versions electronic control units (MCU).

1. Relay box (power contactor)
2. Relay box (power contactor) with integrated radio receiver.
3. Transistor-controlled power electronics with integrated radio receiver that replace the conventional power contactor. (Available from summer 2008.)

The new electronic unit contains no open contacts and is very flexible as regards voltage. The control electronics are software based and feature an integrated radio receiver that communicates with the wireless remote control and built in system to protect the thruster motor and electronic components.

IMPORTANT! Turn off the thruster main switch when not in use. The radio receiver current consumption will be approx 3.5 W as long as it is turned on.

2.4.1. Antenna installation

If wireless remote control option is to be implemented after choosing version 2 or 3:

- If not already installed, the MCU must be fitted with an antenna.
- The remote control and electronic unit must also be coded/taught electronically to communicate with each other.
- Remove the left rubber cover. Then push the antenna through the cover (on one side).
- While holding down the antenna connector handle, push the antenna all the way down into the bottom of the clamp. Release the handle and the antenna is fixed in place.

Replace the rubber cover.

- Start by pushing the rubber cover in by the antenna and continue around the edge until the cover is fixed in place.
- Make sure not to twist the cover with the antenna.

(The remote control will function over short distances even without the antenna.)

2.4.2.Battery replacement

The remote control uses three regular AAA/LR03 alkaline batteries. The battery life is more than two seasons under normal leisure use.
When replacing batteries, open the unit by unscrewing all five screws.

NB:

- The screws are of different lengths and have O-rings under the screw heads.
- Replace the batteries and make sure all point the same way with the + up and the – downwards towards the edge as illustrated.
- Reassemble the back cover and carefully screw the parts together until the housing gasket is slightly compressed. The remote will remain waterproof as long as the O-rings and gasket are intact with correct compression.

NB: To ensure a long lifetime, this remote control has acid-proof machine screws and screw inserts in the housing. The screws may penetrate the housing if screwed carelessly or too much force is used.
(Not covered by the warranty.)

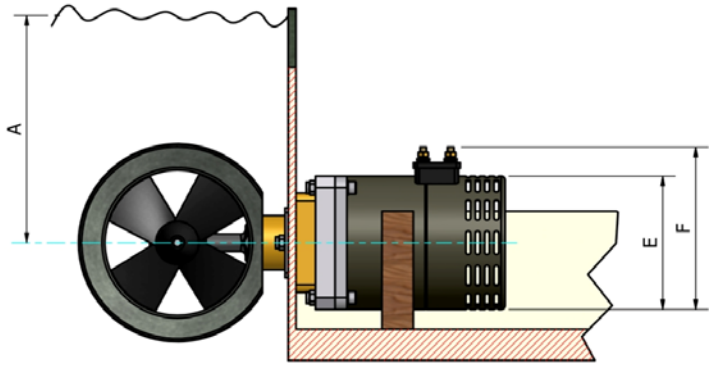
3. Technical specifications wireless remote control

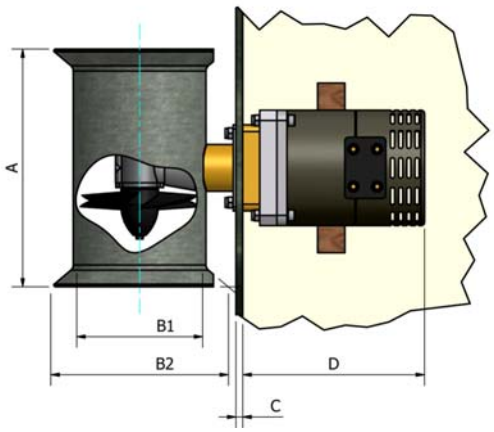
	Wireless remote:	**Motor Control Unit:**
Model:	RC-01	ECU-01
Power supply:	3 x 1.5 V DC (3 x AAA/LR03 batteries)	From thruster (integrated)
Battery life:	2–3 years (normal leisure use)	Not applicable
Communication:	Two-way, narrowband, GFSK modulation	
Operating frequency:	868.075 – 869.125 MHz, CE (EU/EFTA)* 902.175 – 903.025 MHz, FCC (US/Canada)*	
Channels:	16 for communication	
Channel separation:	50 kHz	
Address range:	65.535 (16 bit), spread among the 16 channels	
Temperature range:	-20 to +60 degrees Celsius/-4 to +131 degrees Fahrenheit	
Relative humidity (without condensation):	20% – 90%	
Weight:	105 g	Model dependent
Dimensions (HxWxD):	127x53x22 mm	Model dependent
Environment protection: (Floating)**	IP 68**	IP 41

* May apply to other countries. For information, please contact local authorities for the country concerned.
** Conditional upon correct installation and intact rubber gasket and O-rings

4. Dimensions

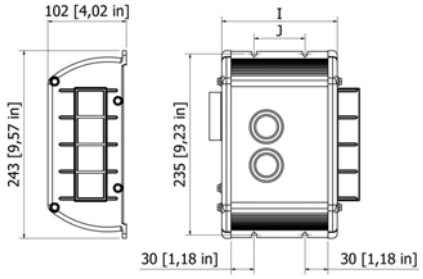
4.1. XF Stern thruster dimensions

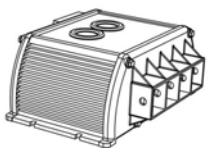




XForce Thruster	A mm	B_1 mm	B_2 mm	C mm	D mm	E mm	F mm	G mm
XF 60 Stern	300	185	250	max.45	270	130	170	278
XF 90 Stern	300	185	250	max.45	320	172	225	278
XF 130 Stern	400	250	310	max.82	320	172	225	375

4.2. Control Unit dimensions





XForce thruster	I mm	J mm
XF 60 Stern / Relay box	150	66
XF 60 Stern / Transistor-controlled power electronics with integrated radio receiver	215	131
XF 90 Stern/ Relay box	150	66
XF 90 Stern / Transistor-controlled power electronics with integrated radio receiver	215	131
XF 130 Stern / Relay box	195	111
XF130 Stern/ Transistor-controlled power electronics with integrated radio receiver	215	131

5. Installation

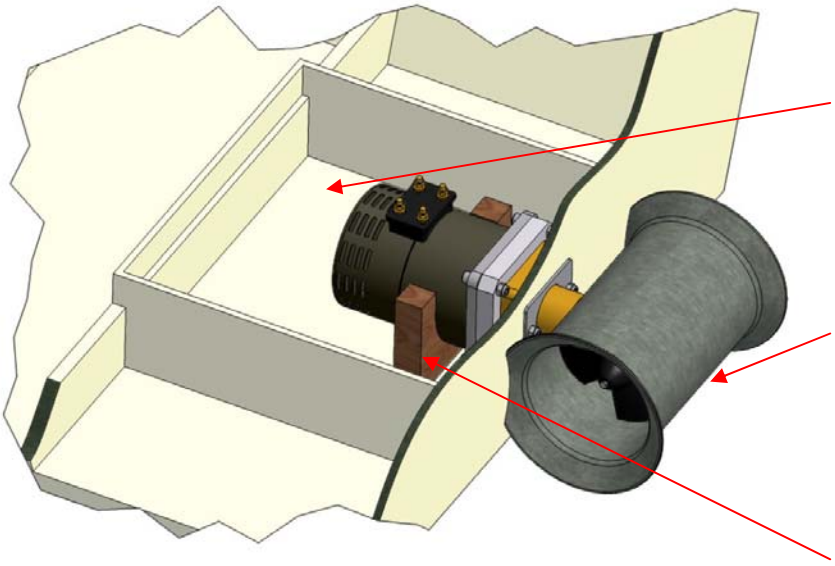
5.1. Avoid water damage

IMPORTANT
Please read these instructions carefully and in their entirety before starting the installation.

To avoid water damage to components, please consider the following:

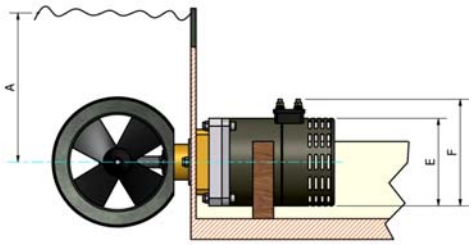
- Seal all drain holes in the thruster installation compartment.
- Drain the surrounding compartments and hatches to the bilge aea in front of the thruster's installation compartment.
- If the propeller shaft logs or rudder components with a high probability for leakage come through the bottom of the boat in the same compartment as the thruster, you must make a separate compartment for the thruster to isolate it from these potential water leaks.
- Ensure that the thruster's installation compartment will not be dripped on if a cockpit, deck or hatch drain fails to operate properly.
- All possible precautions should be taken to ensure that water leaks into the hull will be routed away from the stern thruster compartment.
- You should consider installing an automatic bilge pump in the stern thruster compartment. If you are not confident that you have been able to seal this compartment well, this pump is absolutely necessary.
- The electrical connections for the thrusters must be installed so that all junctions and connectors are kept dry at all times.

5.1.1. Compartment area



- Thruster compartment area must be kept dry all time.
- Fabric glass fibre reinforced polyester tunnel.
- Motor support

5.1.2. Determine the location for the stern thruster



Recommended minimum distance from centre of tunnel to water line:

Model	A mm
XF 60 Stern	240
XF 90 Stern	240
XF 130 Stern	300

Determine the location for the stern thrusters; see installation drawing and dimensional drawing.

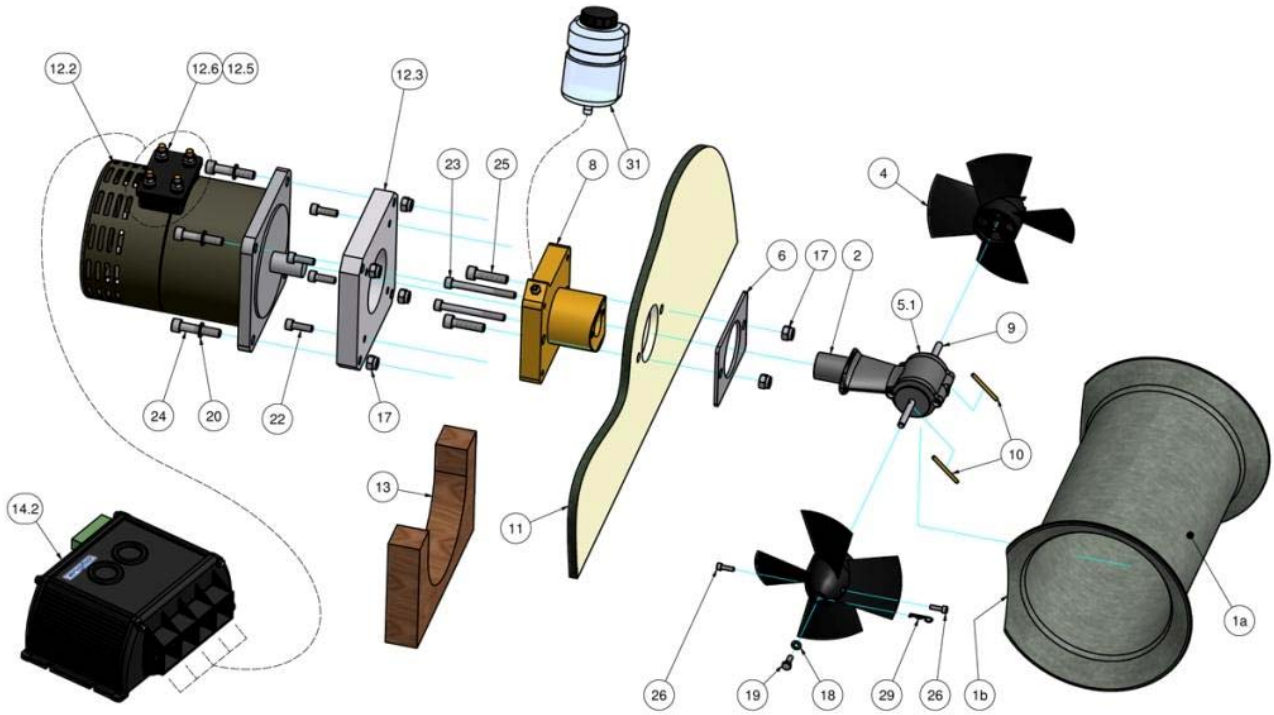
Before you make any cut-outs in the transom, please consider the following.

- Make sure that the water flow from the thruster is not obstructed by stern drive, trim tabs or other moving parts as this will reduce the thrust significantly.
- The propeller tunnel may be positioned off centre on the transom if required by space restrictions.
- Make sure the propeller tunnel does not interfere with the engine's exhaust outlet pipe or allow exhaust to be sucked into the tunnel. The efficiency is reduced considerably if exhaust comes into the tunnel.
- Make sure that it is possible to install a motor support (5.1.1.). Such a device is necessary to reduce stress on the thruster components and tunnel/ transom.

6. Mechanical installation

6.1. Exploded view XForce 90 Stern

(Details differ from XForce 60 and XForce 130)



1. Once the position is determined, hold the propeller tunnel horizontally on the outside of the transom and mark the cut-out for the bracket and the holes for the attachment bolts. Use the support plate (6) as a template.

2. Cut the hole for the bracket (8), in the transom, and drill the holes for the 10 mm bolts.

3. Seal the cut-out section and the bolt holes with two-component primer or equivalent sealer to prevent water from entering into the transom.

4. Buff the propeller tunnel's interior and exterior and clean well with degreaser. Paint the tunnel with primer and antifouling paint.

5. Carefully apply suitable marine sealant on the bracket (8) and support plate (6). Guide the bracket, from within, through the transom.

6. **IMPORTANT:** Make sure the oil nipple is positioned upwards.

   Specified sealants:
   Sikaflex-291,
   Würth Sealant 0890100 or similar.
   NB: Do not use sealant of hard caulk type.

7. Apply sealant to support plate (6) and bolts (23/25). Place the plate on the transom and fit the attachment bolts, from within the transom, through the bracket and transom. Fasten the bolts thoroughly.

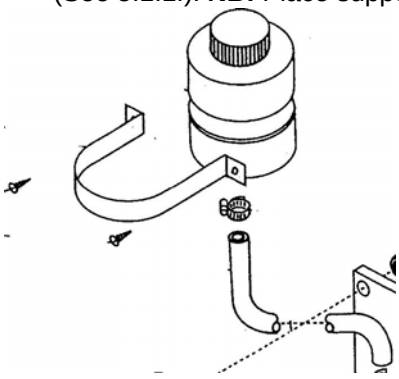
8. Carefully apply sealant to the gear housing (2) before fitting the gear housing to the bracket.
   NB: Make sure to put sealant wherever leakage might occur to prevent any kind of leakage.
   NB: Make sure the sealant does not obstruct the oil hole. (See left.)

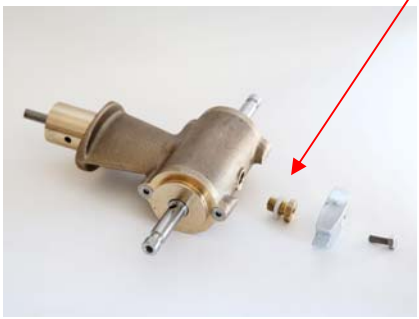
9. Guide the gear housing from within the tunnel through the hole.
   NB: No propeller(s) should be fitted during this process.

10. Guide the two attatchment bolts (23), from within the transom, through the bracket and fasten gear housing and propeller tunnel to the transom.

11. In some cases the tunnel flanges (1b) must be modified to fit close to the transom (11).

12. Fit the motor (12.2) to the bracket (12.3) and screw the units together. The motor has to be properly supported to support the weight of the motor and reduce tension on the transom and thrusters bracket (See 5.1.1.). **NB:** Place support under the motor body, do not place under the fan guard.





13. Attach the oil hose to its base on the bracket (8) and mount the oil container (31) close to the stern thruster but above the water line. The hose should be mounted in such a way that no air traps are formed which could hamper the oil flow to the gear housing.

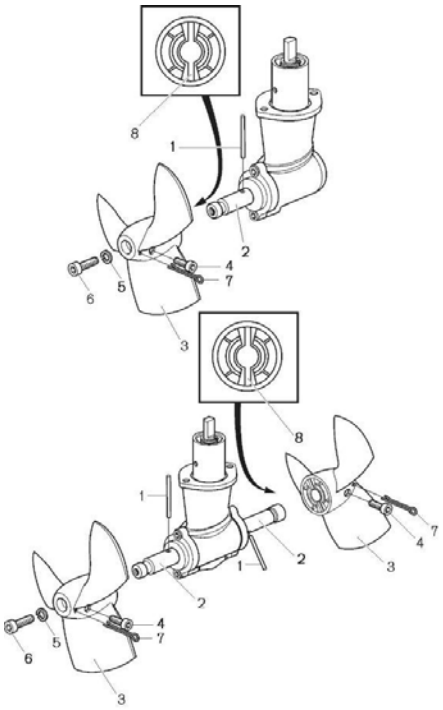
14. Fill the oil container and open the oil drain plug in the gear housing until oil leaks out. Put the oil plug back in place. This is done to speed up the oil flow to the gear housing and also to purge any air that is left in the hose. Refill the oil container (31).

15. Paint gear housing with primer and antifouling paint.
    NB: Do not paint the zinc anode or its contact area.

16. Install the propeller(s) (4) according to the propeller installation instructions.
    NB: The propeller marked LH should be put on port side and the one marked RH on starboard side.

Apply bottom coating
All wet parts in the tunnel must be covered with bottom coating.

Ensure that the installation has no leaks when the boat is set afloat.

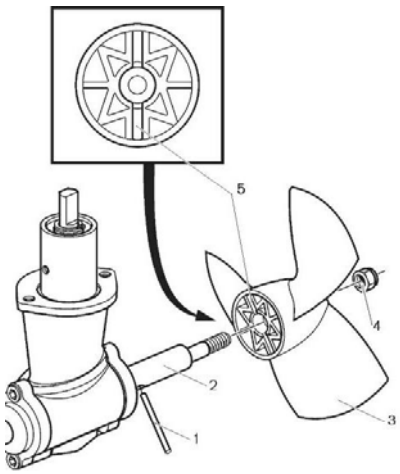


6.2. Propeller installation

Symmetrical 4 blade kaplan propellers. Glass fibre reinforced acetal (POM).

XForce 60 Stern and XForce 90 Stern:

- Install the driver pin (1) into the hole in the propeller shaft (2).
- Fit the propeller (3) with the 2 screws (4).
- Make sure that the screws (4) enter the groove in the propeller shaft (2) and that the driver pin is located properly into the groove (8) in the propeller.
- Lock the propeller into position with the screw (6), washer (5) and cotter pin (7)
- (Bolt torque , M6: ab. 8 Nm and M8: ab. 20 Nm.).



Xforce 130 stern:

- Install the driver pin (1) into the hole in the propeller shaft (2).
- Fit the propeller (3) making sure the drive pin is located properly in the groove on the propeller (5).
- Fasten the propeller (3) with the locking nut (4). (Locking nut torque , M6: ab. 8 Nm and M8: ab. 20 Nm.)

7. Electrical connections

IMPORTANT:

- Professional qualified craftsmen must carry out the electrical work, and responsibility for the installation rests entirely in the hands of the installer.
- Failure to adhere to these requirements will result in the loss of guarantee coverage.

WARNING:

- The electric power must be turned off during installation.
- The minimum requirements stated below with reference to battery capacity, cable length and cable diameter must be adhered to in order to avoid reduced performance and operational malfunction.
-

Battery capacity: Refer to XForce Thruster requirements (7.9).

Recommended main switch:

- XF 60 Stern: Part no. 12-00050
- XF 90 Stern, XF 130 Stern: Part no: 12-00087

WARNING:

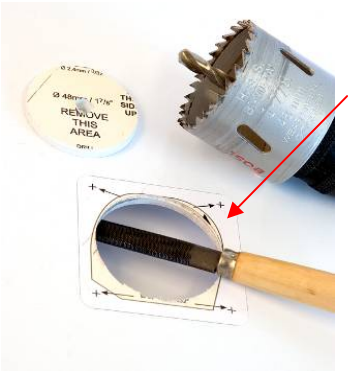
- Mind your fingers when testing the propeller!
- Ensure that no objects are in the tunnel before testing!
- Make sure that the battery is fully charged before testing.
- The thruster must only be operated in water.
- Do not remove belt cover when power is connected

NB: All cables between the motor control unit and the motor should be kept as short as possible for optimum performance.

7.1. Installation- touch panel

- Decide where to place the panel.
- Drill a Ø 15 mm hole.
- Thread the panel cable trough the hole. Clean the surface.
- Remove the covering paper on the back of the panel and stick the panel onto the surface. The holes in the panel corners may be used to fasten the panel with screws if needed. Tighten with care.

NB: For optimum appearance, be particular about lining up the panel before sticking it on.



7.2. Installation- joystick

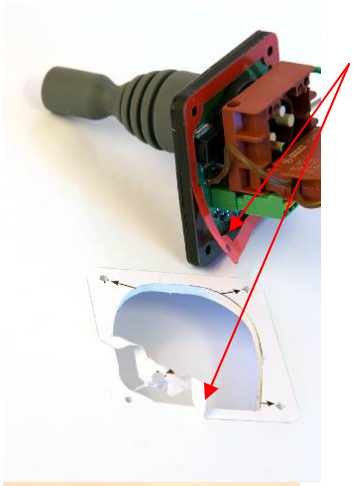
The joystick panel, (single or double), comes complete with;

- Joystick with gasket and connection plug(s)
- Drill template
- Self tapping screws
- Manual

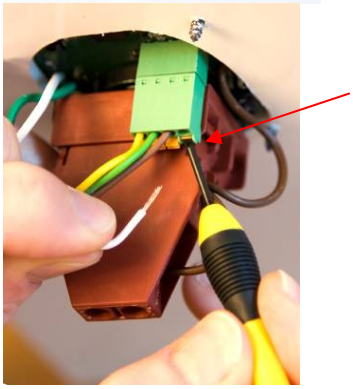
Mounting

- Turn off the main switch to the electrical thruster.
- Select the mounting position for the joystick panel. The desired position must be even and in a location that will prevent water from rain or sea spray to be able to access the back of the panel. Remove all grease, dust or dirt before affixing the drill template.

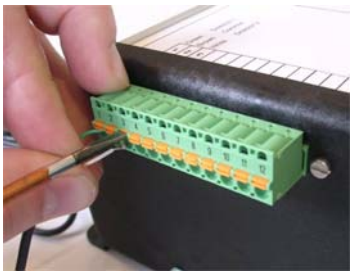
- Mount the drill template sticker and use a hole saw and a file to remove all needed area for installation. Pre-drill the four fastening holes with Ø2,4mm, (3/32”).



- Remove the drill template and remove the red cover film from the gasket.
- Install the panel carefully and fix it in place with the four black stainless screws.



- Connect the wires to the panel as shown on the connection diagram(s).
- The wires are connected by pressing in the button placed under the hole while the wire is being pushed into the hole. Release the button when the wire is in place.
- Check for good connection by pulling gently in the wires.
- Correct connection is;
    1. White (Direction 1)
    2. Brown (Common)
    3. Green (Direction 2)
    4. Yellow (+ supply from 1 A fuse connected ater thruster main switch or directly to MCU from MCU serial no. 200473 and later.)



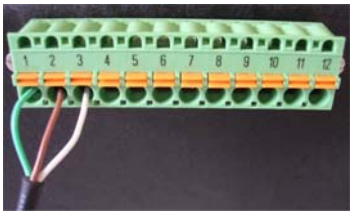
7.3. Connecting the control cable

- The wires are connected by pressing in the button placed over the hole while the wire is being pushed into the hole.
- Release the button when the wire is in place.
- Check for good connection by pulling gently in the wires.

NB: The wiring must be connected as follows:

Touch panel:

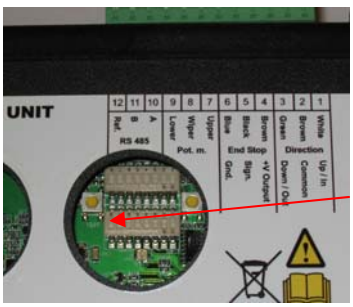
1. Green
2. Brown
3. White



Joystick (from MCU serial no. 200473):

1. Green
2. Brown
3. White
4. Yellow

On boats with more than one steering/control position, the wires must be connected in parallel into 1, 2, 3 (and 4).



7.4. ontradicting direction

If the operating direction when using the remote transmitter is wrong, follow the procedure below.

- Turn off the main switch.
- Remove the rubber cover on the Control Unit.
- Change position on DIL switch 8 on S100 and exchange wires 1 and 3 on the 12 pin green connector.

- Turn on the main switch and verify in a safe and controlled manner correct operation from all operation panels and the remote transmitter.
- If the operating direction when using the fixed panel is wrong exchange wires 1 and 3 on the green 12 pin connector.

7.5. Control box connections

Tips for mounting:

- Pre-cut correct cable-lengths and mount cable-lugs in advance so mounting the cables on the box can be done in a comfortable position before the unit is mounted in the boat.

- One will need 2 pcs 13mm spanners to secure the M8-bolts.

- Correct torque is 20 Nm for the Stainless Steel bolts, (A4).

- **NB:** Always begin the mounting/assembly from the left, entering the bolt with a big washer through the cable lug into the hole from the right.

- All cable-lugs shall always be on the right side, in direct contact with the copper-bar. **NB:** On bar 4, two cables as shown on picture.

- Use M8x20mm bolts for copper-bars number; 1, 2, 3, and 5 and M8x25mm for bar number 4. It shall also be mounted a plain washer between cable-lug and lock-nut.

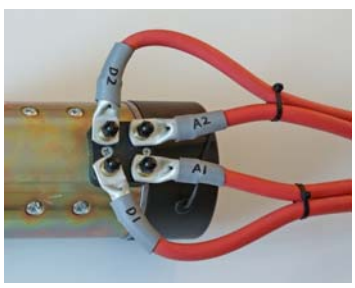
- Mount the three first cables with the cable-lugs pointing in the same direction, as shown in the pictures.

- The mountingbolts are not active current leaders and their only purpose is to assure a tight connection between the cable-lugs and bars.
- Shorter and thicker cables will give less voltage drop and thus better performance.

- **NB:** Please notice how the cable-lugs on copper-bar number 4 is mounted, (turned towards each other to maximize space and ease of montage).

- Cable-lug for bar number 5 is turned the opposite direction compared with number 1, 2 og 3.

- If ever needed to dismount the cables, start from the right side and reverse the above procedure.



7.6. Connecting to the bow thruster

See the pictures and wiring diagram for correct connections.

XForce Stern 60/90/130

NB: Correct cable bolt nut torque is:
- Terminal bolt M8 brass: 10 Nm (7.4 lb.ft)
- Terminal bolt M10 brass: 15 Nm (11.1 lb.ft)

WARNING: After connecting the cables to the connection bolts with correct torque, the bolts with cables will still be able to move relative to

the terminal plate. To make sure that no short circuits (contact) between the terminals can occur, the cables should be secured in such a manner that no short between the terminals can be caused by movement or vibration. The bolts must be protected by plastic cap nuts or protective rubber caps.

7.6.1.Motor terminal connections

The terminal bolts are active current leaders.

The pictures show correct connected cables on the motor terminals. Please note that cable-lug is mounted to the terminal with brass washers on both sides of the cable-lug, then another washer and nut on top of the cable-lug.

Finally, mount isolating rubber caps or plastic cap nuts. (Not shown on these pictures).

7.6.2.Connecting the cables to the battery

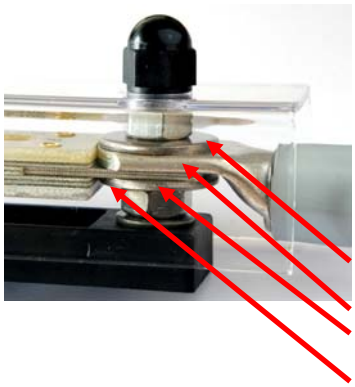
DANGER!
Make sure that no cables are short-circuited before connecting the battery.

WARNING:

- The electric power must be turned off during installation.
- It is recommended to use a dedicated battery bank for high ampere consumption equipment such as thrusters, or in accordance with the engine manufacturer's recommendations.
- Check all high current connections, tighten where necessary.
- Connect the plus (+) and minus (-) cables to the correct poles on the battery and the corresponding contacts on the control unit. The plus (+) cable must be connected via the fuse and main switch.
- Always turn off the thruster main switch when not in use.
- All cables between the control unit and the electric motor must be kept as short as possible. Maximum cable length is 1.5 m (5 ft.) Minimum cable insulation rating is 105°C (221°F).

WARNING:

- To avoid overheating, all connections between the power cable and components must be copper to copper (or copper to brass). No washers of any kind shall be mounted between the power cable lug and the copper bar/component.



7.7. Fuse connections

The picture shows the correct power cable connection to the fuse terminal. Note that the fuse is mounted directly under the power cable lug without any washer in between. There are supporting washers on each side. (Use large washers with large cable lug.)
Recommended torque: 20Nm (M8 A4)
Plastic nuts to be mounted on top of plastic cover

- Supporting washer
- Cable shoe
- Fuse
- Supporting washer

7.8. Recommended main switch

Thruster model	Part no.
XF 60 Stern	12-00050
XF 90 Stern	12-00087
XF 130 Stern	12-00087

Main switch 12-00050

7.8.1. Main switch terminal

The main switch terminal must be isolated as shown in the left-hand picture, i.e. by using rubber caps or plastic nuts.

Main switch 12-00087

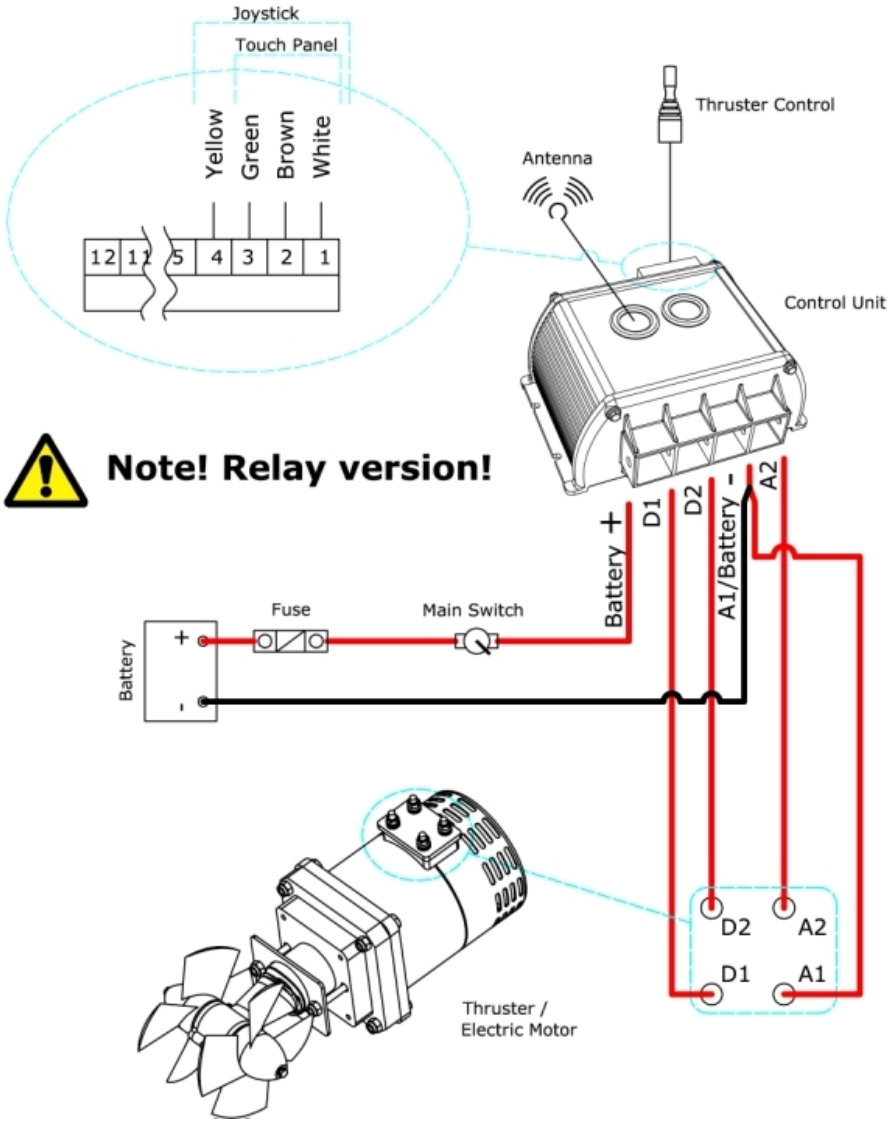
7.9. XForce Thruster Cable, fuse and battery requirements

XForce Thruster	Motor V/kW	Thrust (KG)	Maximum cable length1) Minimum cable dimension		Required min. battery capacity		Rec. fuse amp.	Spare fuse P/N
			Length m/ft	Dim.2) mm2-AWG	Ah/V	CCA (SAE)		
XF60 Stern	12/4	60	1-10/1-33	70-2/0	100 Ah/12 V	800	350	12-00350
XF60 Stern	24/4	60	1-10/1-33	70-2/0	100 Ah/24 V	800	300	12-00300
XF90 Stern	12/5	90	1-10/1-33	95-3/0	100 Ah/12 V	1700	400	12-00400
XF90 Stern	24/5	90	1-10/1-33	95-3/0	150 Ah/24 V	1050	350	12-00350
XF130 Stern	24/7	130	1-10/1-33	120-4/0	175 Ah/24 V	1150	400	12-00400

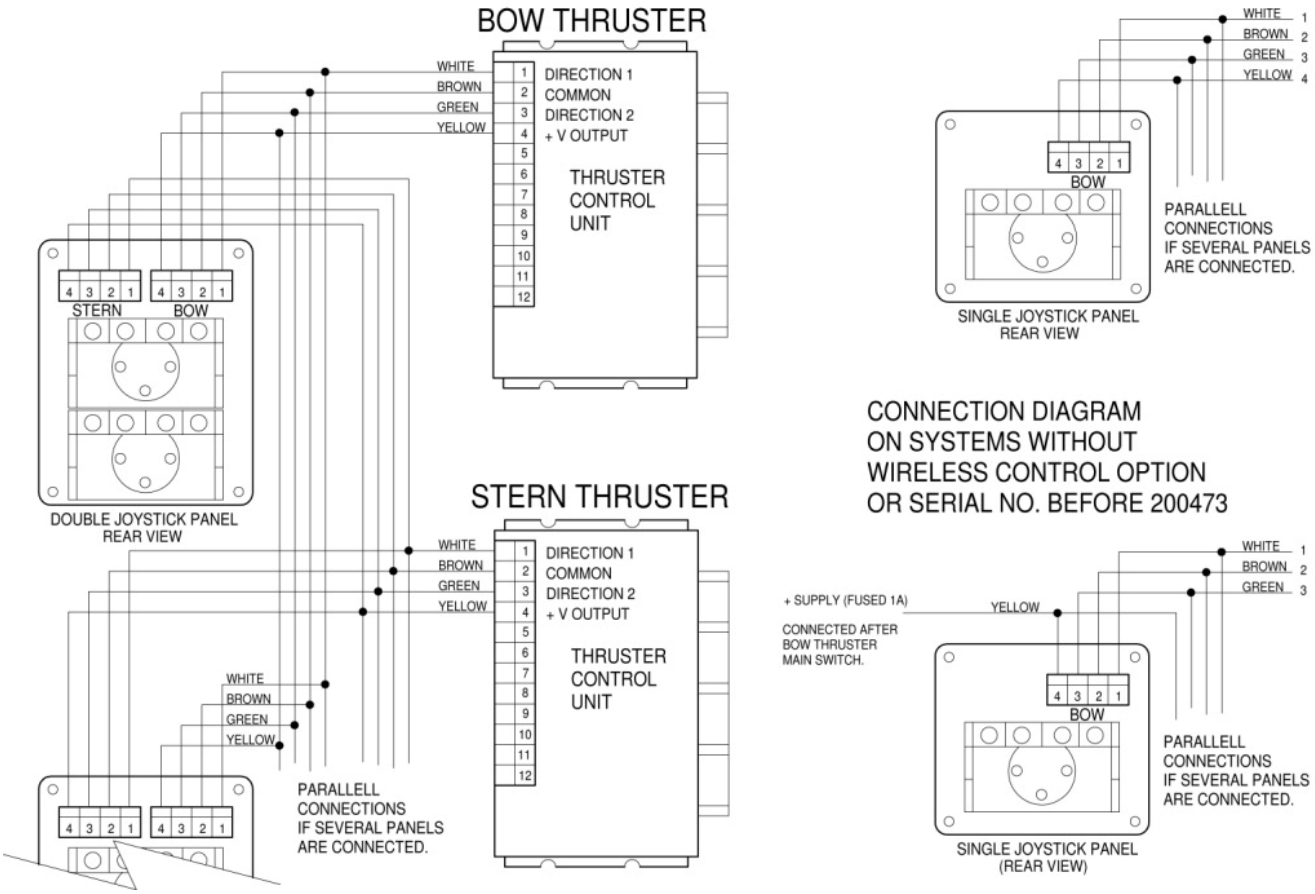
The distance from the thruster unit to the battery, one way, each cable.
Use of even larger cable dimensions and battery capasity will give the thrusters better performance.
2) Wiring insulation rating is 105°C (221°F) minimum.

7.10. Wiring diagrams

7.10.1. XForce stern 60/90/130



7.10.2. Wiring diagram single and double joystick



IMPORTANT!

- The control unit and electric motor must be the same voltage version as the battery system it is connected to.

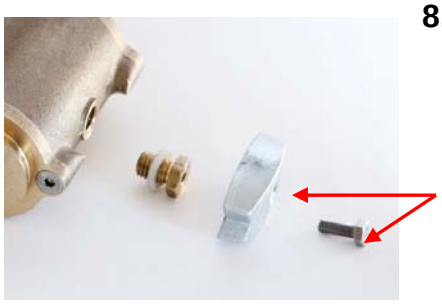
8. Maintenance

WARNING: Before maintenance the main switch must be turned off.

Seasonal maintenance/check.
Prior to use before each season, or at least once a year, the following checks must be carried out:

8.1. Mechanical check

- Check for loose bolts, supports, covers and cable supports. Check the propeller.



8.2. Corrosion check

- An inadequate configuration of the on board electric system can result in galvanic corrosion, electrolysis. Use of shore power combined with earth failure will some times accelerate the process. This will lead to corrosion of the metal components.
- Periodic inspection of gearhousing and metal parts is necessary to detect and initiate action to avoid corrosion damage, such as replacing the zinc anode. Unscrew the bolt, switch zinc anode and screw the bolt back in place.

8.3. Battery/charger check

- Check the battery for clean and tight terminals and correct electrolyte level.
- Check the charging voltage measured on the battery.
  Correct charging voltage at 20°C (68°F) is:
- 14.4 V on 12 V systems
- 28.8 V on 24 V systems

8.4. High current cable/connections check

- Check all high current components and connections, including battery fuse, main switch, possible bulkhead feed-through, motor and control unit connections.

  Minimum voltage measured on the motor during operation should be min.;
- 10.5 V on 12 V systems
- 21.0 V on 24 V systems
- All thruster performance specifications measured by 10.5 / 21 V.

If the voltage is below 10.5 V / 21 V the contactor will have low contact pressure. The contacts can then easily burn or fuse together and the thruster contactor must then be replaced.
NB: The electronic security system will, if necessary, cut the power and the thruster stop.

8.5. Joystick/operator panel check

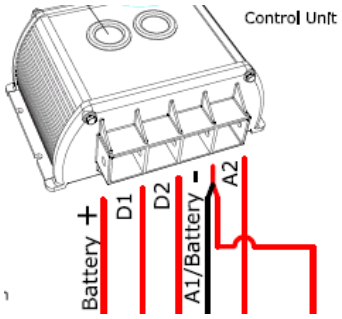
The motor can be tested in both directions without the joystick/operator panel connected, as described below.

- Short between terminal 1 and 2 on the control unit and the motor will run in one direction.
- Short between 2 and 3 and the motor will run in the opposite direction.
- Measure zero resistance, with wires disconnected from the control unit, between the green and brown wire, and between the brown and white wire from the joystick/operator panel when operating the lever/switch.
- This test will show whether the joystick/operator panel (with cable) is working and whether the control unit is working.

9. **Troubleshooting**

9.1. The thruster does not work

- Turn on the thruster main switch.
- Check fuse.
- Check battery.
- Check all el. connections on the control unit and battery cables.



9.2. The thruster does not work or has an unexpectedly low performance

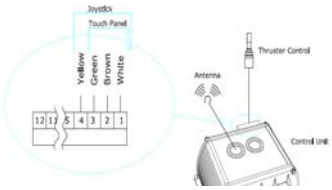
- Check the voltage at the control unit terminal (battery + and battery -) while trying to run it. If measured voltage of less than 10.5 V (12 V system) and 21 V (24 V system) the performance will drop and in the end the thruster will stop working.
- If wireless remote is correctly coded and available, check the “POWER” indicator on the remote.

Orange light

- Low voltage at the electronic unit is indicated by an orange light in the “POWER” indicator.

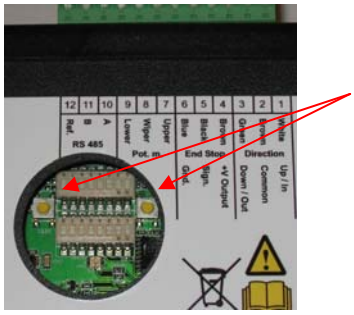
Red light

- The indicator will quickly blink red in case of system faults and slowly blink red together with short sounds if the remote is unable to communicate with the electronic unit.
- If the thruster is overloaded and requires time to cool down, this will also be indicated by a quick red flashing.
- These error indications are shown when buttons on the wireless remote are pushed.



9.3. The thruster runs in the wrong direction

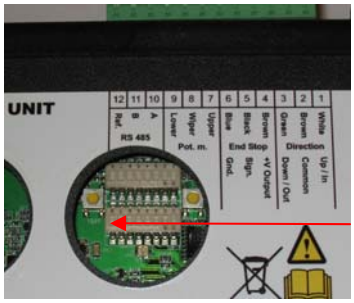
- Check the panel cable connections on the control unit terminal.
- Swap wire 1 and 3 if necessary.



9.4. The thruster just works in one direction

- Check connection on terminals 1, 2 and 3 (12 pin connector) on the control unit. Remove the rubber cover closest to the connector and test both directions by pushing the small yellow switches.
- If the thruster now works normal, check the cable connections between the control unit and the joystick.

If the thruster still does not work, study point 8.5.



9.5. The thruster runs in contradicting direction

If the operating direction when using the remote transmitter is wrong, follow the procedure below.

- Turn off the main switch.
- Remove the rubber cover on the Control Unit.
- Change position on DIL switch 8 on S100 and exchange wires 1 and 3 on the 12 pin green connector.
- Turn on the main switch and verify in a safe and controlled manner correct operation from all operation panels and the remote transmitter.
- If the operating direction when using the fixed panel is wrong exchange wires 1 and 3 on the green 12 pin connector.

9.6. The thruster runs for short intervals or a clicking sound is to be heard from the thruster

- Check the voltage on battery +, and battery – on the control unit when trying to run the thrusters. The voltage must be minimum 10.5 V (12 V system) and 21 V (24 V system).

9.7. The thruster stops working after a long period of use

Intelligent electronic protection
WARNING:

- The system has intelligent monitoring to measure run and pause time. The XForce Thruster is not permitted to start if the voltage on the thruster is below 10.0V on 12V system/ 20.0V on 24V system. If the voltage at the thruster drops below 9.0/18.0V when thruster is running, warning will occur by showing orange light power light on the wireless control.

- Of security reasons, the system permits continuous running of the thruster in 4 intervals of 30 sec. After each interval, the thruster will stop. Switching off / on the joystick or switch panel will make the thruster run again. If repeated 4 times, (total 2 minutes running), the thruster will need to cool down for 25 minutes before being ready to run again. This to protect the motor and control unit against overheating.

- **NB:** In an emergency situation, to save the ship at the possible expense of the thruster, this protection can be override by turning the main switch off and on.

- Check the thruster, control unit, fuse, cables and electric connections for visible signs of overheating, bad connection and short circuit.

10. Installation of equipment with high currents.

10.1. Special considerations.

10.1.1. Preface/introduction.

- Engbo has experienced that over 90 % of our service-/problem enquieries, is related to power supply. This document has been made to try to address and help avoid the most common and known problems that can arise.
- General. There are special considerations that must be taken into account regarding installation, use and maintenance of high current consumption equipment. It is therefore especially important that only persons with the appropriate knowledge are doing this kind of work.

- The most common products which this document applies to are electrical bow and/or stern thrusters, windlasses and electrical starters for main and/or help engines.
- (Similar precautions must also be taken with generators and charging systems for batteries).

- Such equipment has, or can have for shorter periods, many hundreds of ampere of current consumption.
- In-rush current in an electrical motor of this kind will typically be around 2-3 times nominal current and can easily exceed 1000 A for short periods. Currents of these sizes will generate heat in all components, including cables.
- It is therefore very important that all components, including the connections of these components, are done correctly to keep the connection resistance and the total resistance in the electrical circuit as low as possible.

- All connections between cable-lug and components shall always be directly copper against copper, (or copper against brass). There shall never be any washers of any kind, or anything else, between the connections.

- Wrong or improper use or wrong connection of such high currents components will generate a lot of heat which in worst case can cause fire.

10.2. Battery

- The battery capacity must be related to the connected equipment and the use of this. For recommened size and capacity, please refer to the product specifications. Generally will a battery with higher capasity give better performance. Start-type batteries can generally give higher currents, (for a short period), than leisure/standard type and is therefore better suited for the kind of equipment mentioned above. It is important to understand the difference between battery voltage and battery capasity. An old or damaged big battery can have rest-capasity equivalent of a small motorcycle battery while it is still possible to measure a correct charging voltage of approx 14,4V DC and apparently a good no-load voltage of approx 12,8 V DC. (No-load voltage must be measured directly on the battery-posts after a couple of hours without charging from motor or landbased supply.

- Special “high-start-current” and similar kind of batteries are normally suited for only the smallest thruster models and windlasses as they normally have too little capasity (Ah).

10.2.1. Battery-cables/lugs

- Battery-cables must be related accordingly to the equipment it is connected to. Please refer to the product specifications for recommended relation between size and length. Generally speaking, a thicker cable dimension will give better performance, especially with longer cables. Use only cable-lugs of high quality. These must only be mounted on the cables with correct tool and correct according to the procedure from the cale lug manufacturer.

- Never use a vise, wrench or similar to press on a cable-lug. Although it may look like a good connection, over time it may become a source of ignition.

- The difference between two types of cable-lugs is clearly shown in the picture. The left one illustrates a ring-type cable-lug, and is acceptable for products with currents up to ca 200A. The right cable-lug is of press-on type, and shall be used on thrusters.

10.2.2. Battery connection

- The pictures show a correct connected batterycable. Notice that the cable-lug is mounted onto the batterypost with washer and nut only on the overside of the cable-lug. Nothing must be placed between the battery terminal clamp and cable-lug.

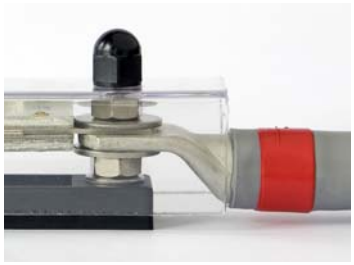
- It excists different kinds of battery connections. Use only a type with bolts, and not any kind of ”spring” or ”clip-on” solutions.

- If more than one cable/cable-lug has to be mounted on the same battery-post, the one with the greatest current shall always be the lowest or closest to the battery.

- Follow the instructions for applying the correct torque on the bolts.

- After the cables have been mounted, protective and isolating rubber-cap shall be mounted.

10.2.3. Fuse connection



- The bolt itself is not an active current conductor, and its only function is to assure a tight fit between the fuse and the cable-lug.

- The picture shows a correct connected cable to the fuseholder. Please note that fuse and cable-lug is in direct contact with a big washer over the fuse and under the cable-lug. There must be nothing between the fuse and the cable-lug.
- Correct torque for a Stainless Steel bolt, (A4), is 20 Nm.

10.2.4. Main switch connection

The bolt itself is an active current conductor.

- The pictures show a correct main switch connection.
- Please note that the cable-lug is mounted directly onto the terminal post, washer and nut is on top of the cable-lug.

Different kinds of main switches with different kinds of terminals excist. Correct torque is;

- M8 Brass/copper: 10 Nm
- M10 Brass/copper: 15 Nm

The picture shows isolating rubber-caps mounted on both terminals. (For improved understanding, the interrupter is not mounted on the bulkhead.)

Declaration of Conformity

We, the undersigned (☒ Manufacturer / ☐ The manufacturers authorized representative established within EEA):

Company	ENGBO AS
Address	Wirgenesvei 7, N-3157 Barkåker
Country	NORWAY
Telephone number	+47 3300 3150
Telefax number	+47 3300 3160
E-mail	support@engbo.no

Certify and declare under our responsibility that the following products:

Product Description	Remote control unit and/or electronic control unit for electric side thrusters and electric windlasses and mooring motors.
Manufacturer	Engbo AS
Brand Name	Complete BP series thruster systems, Complete CT series thruster systems with control units. Mini/Midi/Maxi and 30 and 40 series windlasses and mooring systems.
Model/Type	RC-01 and ECU-01 units and modules.

Is tested to and conforms with the essential test suites included in the following standards, which are in force within the EEA:

Standard	**Issue date**	**Reference to report/file**
IEC 60950-1:2001 EN 60950-1:2001,A11:2004		Test report 53207, Nemko AS
EN 301 489-1:V.1.4.1		Test report 04/695/3, N-Comlab, variable speed drive off
EN 301 489-17:V.1.2.1		Test report 04/695/3, N-Comlab, variable speed drive off.
EN 61800-3:2004		Test report 04/695/3, N-Comlab, variable speed drive on.
IEC 60533:1999		Variable speed drive on.
EN 300 220-3: V.1.1.1		Test report 04/695/2, N-Comlab

And therefore complies with the essential requirements of the following directives:

Directive Name	**Directive number**	**Further identification**
R&TTE directive	1999/5/EC	
EMC directive	89/336/EEC	
General Product Safety Directive	2001/95/EC	
LVD Directive	73/23/EEC	Low Voltage Directive

The following Notified Bodies have been consulted in the Conformity Assessment procedure (whenever applicable):

Notified Body number	**Name and address**
0470	Nemko AS, Gaustadalleen 30, P.O. Box 73 Blindern, N-0314 OSLO NORWAY

The technical documentation as required by the conformity assessment procedure is kept at the following address for a period ending at least 10 years after the last product has been manufactured at the disposal of the relevant national authorities of any Member State for inspection:

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Country	NORWAY
Telephone number	+47 3300 3150
Telefax number	+47 3300 3160
E-mail	support@engbo.no

Product is CE-marked in	NORWAY

Drawn up in Tønsberg	NORWAY
Date 3/3 -2006	2006-02-08
Øystein Enger	engbo® ENGBO AS – *et selskap i Engbo gruppen* Pb. 2288 PT, 3103 Tønsberg, Tlf.: 33 00 31 50 Fax: 33 00 31 60
Signature and Company Stamp	Øystein Enger, General Manager